

“6b”. Applicant further respectfully submits that due to typographical errors, lines 24 and 25 of page 9 erroneously contains reference numbers “69” and “66,” instead of the correct reference numbers “6a” and “6b.”

The present specification has been amended above to correct these errors. Accordingly, reconsideration and withdrawal of the objection to the drawings is respectfully requested.

CLAIM OBJECTIONS

In the Office Action, the Examiner points out that the numbering of the claims, as originally filed, was incorrect. The Examiner further states that misnumbered claims 3 (second occurrence) and 4 have been renumbered 4 and 5, respectively. Applicant has made note of this renumbering of the claims.

35 U.S.C. § 112, SECOND PARAGRAPH, REJECTIONS

Claims 12-21, 23, and 24 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Specifically, the Examiner asserts that each of the above-identified have insufficient antecedent basis for one or more recited features.

Applicant respectfully submits that the claims have been amended to provide sufficient antecedent basis for their recited features. Applicant

further respectfully submits that such amendments do not further limit the scope of the claims. Reconsideration and withdrawal of this rejection is respectfully requested.

SYNOPSIS OF THE PRESENT INVENTION

In general, annular piezoelectric transformers may be adapted to operate with two different resonance frequencies, corresponding to dimensions of either a peripheral length or of a cross-section of the annular body. The present invention solves the problem of providing a transformer adapted to be operated at a resonance frequency corresponding to the dimension of a cross-section of the annular body, which is substantially perpendicular to the peripheral direction of the annular body.

Accordingly the transformer of the present invention is adapted to operate at a comparatively higher frequency as it operates on a transverse dimension vibration, or thickness vibration, instead of a peripheral vibration (see page 2, lines 8-18 of the specification). The present invention solves the problems associated with overtones from lower resonance frequencies due to a geometry with substantially no overtones, specifically, an annular shaped geometry.

When operating piezoelectric transformers in high frequencies, it is a common problem that the working resonance is disturbed by overtones from lower resonance frequencies. Commonly known piezoelectric

transformers, such as the transformer disclosed by the Schafft patent cited in the Office Action, are adapted to operate according to a resonance frequency associated with a dimension of peripheral length of the annular body. The resonance frequency associated with the peripheral length is relatively low compared with the resonance frequencies corresponding to a dimension of cross-section of the annular body.

Since hoop mode transformers are typically configured for the lowest resonance frequency (the peripheral length is, in general, substantially longer than the cross-section -- see Schafft, column 3, lines 24-36, and Figs. 2 and 3), overtones from lower resonance frequencies seldom cause any problems. Accordingly, prior art documents relating to hoop mode transformers are not concerned with a design that eliminates overtones or "parasitic" waves. None of the references cited in the Office Action are concerned with the problem addressed by the present invention.

CITED PRIOR ART

Schafft Patent

U.S. Patent No. 3,562,563 to Schafft (hereafter Schafft) discloses a ring-shaped transformer. However, Schafft provides no disclosure whatsoever of a transformer capable of being operated with a resonance frequency of a transverse dimension. Furthermore, Schafft in no way

suggests, or even hints, to one of ordinary skill in the art to use an annular body for solving the problems of overtones occurring in transformers adapted to work at a resonance frequency of a transverse dimension.

Kitami Patent

U.S. Patent No. 5,861,704 to Kitami et al. (hereafter Kitami) teaches a transformer which is capable of being operated with a resonance frequency of a transverse dimension. However, the transformer of Kitami does not solve the problem of overtones from lower resonance frequencies by providing a substantially annular piezoelectric body. In fact, Kitami does not address the problem of interference with overtones from lower frequencies.

35 U.S.C. § 102(b) REJECTION -- SCHAFFT

Claims 1-5 and 7-9 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent NO. 3,562,563 to Schafft (hereafter Schafft). This rejection is respectfully traversed for the following reasons.

Independent claim 1 recites a primary and secondary portion that have been polarized substantially perpendicular to the peripheral direction of the annular body (see lines 9-10). Applicant respectfully submits that Schafft fails to teach or suggest this feature.

Schafft discloses a piezoelectric transformer with a primary portion and a secondary portion capable of generating and transforming piezoelectric vibrations in accordance with an AC voltage. However, as Schafft clearly discloses in column 1, lines 64-65, the polarization of the driven sections (the secondary portions) is along the circumference thereof. Also see Schafft, column 6, lines 7-10.

Accordingly, Schafft fails to disclose that both the primary **and** secondary portions have been polarized substantially perpendicular to the peripheral direction of the annular body, as required by claim 1. The transformer of Schafft is configured to operate in hoop mode (see column 1, lines 19-22; column 2, lines 16-18; and column 6, lines 7-10 of Schafft). In other words, Schafft's disclosed transformer is to be operated at a frequency corresponding to a dimension of the peripheral length of the annular body. Conversely, the transformer of the present invention is configured to operate in at a resonance frequency of a dimension of a cross-section of the annular body, i.e., in thickness mode.

The hoop mode of Schafft's transformer and the thickness mode of the present invention corresponds to two different types of resonant vibration, where hoop mode is caused by the circumferential polarization disclosed by Schafft and thickness mode is caused by the perpendicular polarization of the present invention.

Applicant respectfully submits that claim 1 is not anticipated by Schafft at least for the reasons set forth above. Accordingly, Applicant

respectfully submits that claims 2-5 and 7-9 are also allowable over Schafft, by virtue of their dependence on claim 1, at least for the reasons set forth above. Reconsideration and withdrawal of this rejection is respectfully requested.

35 U.S.C. § 102(b) REJECTION -- KITAMI ET AL.

Claims 1, 6, and 22-24 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent NO. 5,861,704 to Kitami et al. This rejection is respectfully traversed for the following reasons.

Independent claim 1 recites a piezoelectric body having a substantially annular body (lines 5-6). Applicant respectfully submits that Kitami fails to disclose this feature.

Kitami discloses a piezoelectric transformer, having a primary portion and a secondary portion capable of generating and transforming vibrations. However, Kitami discloses that these portions are cylindrical in shape in the abstract and lines 8, 12, 24, and 52 of column 5 (see also Figs. 2-11).

Accordingly, Kitami fails to disclose annular, i.e., ring-shaped, body (see, e.g., Webster's New World Dictionary). Applicant respectfully submits that the words of a claim, such as the term "annular" in claim 1, must be given their plain meaning according to MPEP § 2111.01.

It is clearly evident that Kitami fails to disclose an annular body because Kitami only discloses dimensions in terms of diameter and

length. If Kitami's disclosed piezoelectric transformer were annular in shape, Kitami should mention both an inner and outer diameter.

Applicant respectfully submits that claim 1 is allowable over Kitami at least for the reasons set forth above. Accordingly, Applicant respectfully submits that claims 6, 22, and 23 are allowable over Kitami, by virtue of their dependence on claim 1, at least for the reasons set forth above. Reconsideration and withdrawal of the rejection of claims 1, 6, 22, and 23 is respectfully requested.

Independent claim 24 recites two portions, where the piezoelectric material between an electrode embedded in one of the portions and the other portion is used as a galvanic separation. Applicant respectfully submits that Kitami fails to disclose this feature.

Kitami's piezoelectric transformer is supported by a structure including a ring 36 and an electrically insulating, resilient silicone resin 37 sandwiched between an inner surface of ring 36 and an outer surface of the piezoelectric body 1, as shown in Fig. 11. Also, see column 18, lines 38-44 of Kitami. Accordingly, element 37 of Kitami is not disclosed as a piezoelectric material, but rather a silicone resin.

Further, the silicone resin 37 is not provided between the primary and secondary portion, as alleged by the Examiner in page 7 of the Office Action. Rather, silicone resin 37 is provided between an inner surface of the ring 36 and an outer surface of the piezoelectric body 1. Accordingly, material 37 provides galvanic separation between the piezoelectric body 1

and the ring 36; however, this galvanic separation is not between the primary and secondary portion. Therefore, the galvanic separation of Kitami cannot in any way actively participate in the power transfer of the device, i.e., actively participate in transferring vibrations between the primary and secondary portions.

Applicant respectfully submits that claim 24 is not anticipated by Kitami at least for the reasons set forth above. Reconsideration and withdrawal of this rejection is respectfully requested.

35 U.S.C. § 103(a) REJECTION -- SCHAFFT IN VIEW OF COMMON KNOWLEDGE IN THE ART

Claims 12-21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Schafft in view of common knowledge in the art. This rejection is respectfully traversed for the following reasons.

Applicant respectfully submits that the Examiner's proposed modifications to Schafft in the rejection of claims 12-21 fail to remedy the deficiencies of Schafft as set forth above with respect to independent claim 1. Accordingly, Applicant respectfully submits that claims 12-21 are allowable over Schafft and the common knowledge in the art, by virtue of their dependence on claim 1, at least for the reasons set forth above in connection with claim 1. Reconsideration and withdrawal of this rejection is respectfully requested.

CONCLUSION

In view of the above amendments and remarks, reconsideration of the various rejections and allowance of claims 1-24 is respectfully requested.

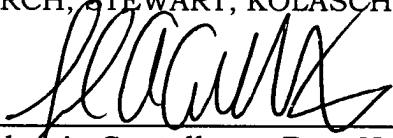
Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact John A. Castellano, Reg. No. 35,094 at the telephone number of the undersigned below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment: Version with Markings to Show Changes Made